N93-22118

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GENERAL DYNAMICS, SPACE SYSTEMS DIVISION

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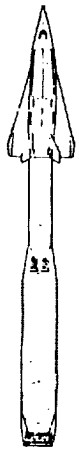
- HYPERSONIC VEHICLES STUDIES
  - Aerothermal / Structural Concepts — AFWAL — 1985-1987
- AEROBRAKING SPACE TRANSFER VEHICLES (ASTV) STUDIES
  - Concepts Definition studies/ Turnaround Operations/ Space Navigation and Aerobraking/ Centaur- derived Lunar Transfer Vehicles — NASA centers — 1979-1990
  - ASTV-related IR&D Studies involving wind- tunnel testing, aerothermodynamics, GN&C and STV design studies — 1983-1991

AEROTHERMAL / STRUCTURAL CONCEPTS STUDY

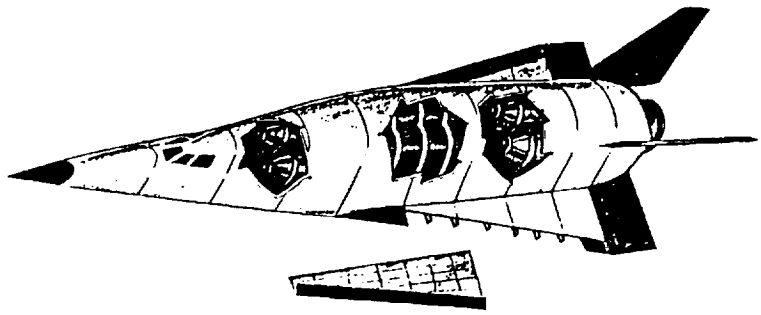
OBJECTIVES

- Establish aerothermal environments for hypersonic aerospace vehicles.
- Develop thermostructural design concepts.
- Obtain optimum Thermostructural designs by performing trade studies
- Identify areas for further development



Length	95 ft
Height	26 ft 8 in.
Wing span	37 ft 6 in.
Takeoff weight	98,000 lb
Payload	5,000 lb
Empty	43,000 lb
Propellants	48,400 lb
LO_2	41,500 lb
LH_2	6,900 lb

Suborbital vehicle and booster



TPS TECHNOLOGY REQUIREMENTS

- ADVANCED RADIATORS, INSULATORS AND ABLATORS
  - COATED REFRACTORY METALS
  - RIGID CERAMICS
  - FLEXIBLE CERAMICS
  - ADVANCED CARBON CARBON
- ACTIVE COOLING DEVICES FOR HOT STRUCTURES

PROGRAM ENABLING TECHNOLOGY ASSESSMENT

Program Area: Hypersonics **Technology Area:** Aerothermodynamics

Priority Requirement (Source) / Enabling Technology	Government Technology Development	Industry Technology Development
Aerodynamic Heating	Current • SEI Studies • NASP related studies • HYFLEX	Current
Enabling Technology Real gas effects Boundary layer transition Turbulence modeling Shock boundary layer interaction Shock impingement Rarefied flows Chemical non-equilibrium Thermal non-equilibrium Surface catalysis/surface reflectance	Needed • Validated CFD methods • Ground test (materials) data • Flight test data - HGV flight test - AFE (14' brake) - Deployable AFE (45' brake)	Needed
Thermal Control	Current	Current
Enabling Technology High temperature heat pipes Nose-tip and Leading edge cooling/ temperature control Active cooling Antenna cooling Electronics cooling Insulation Ablation	Needed	Needed

PROGRAM ENABLING TECHNOLOGY ASSESSMENT

Program Area: Hypersonics **Technology Area:** High Temperature Structures and TPS

Priority Requirement (Source) Enabling Technology	Government Technology Development	Industry Technology Development
Affordable, Reliable Hot Structures	Current	Current
Enabling Technology High temperature materials Hybrid design Joints, seals and adhesives Nose and leading edge Fasteners	Needed	Needed
High Temperature TPS	Current	Current
Enabling Technology Carbon/carbon insulation High temperature flexible TPS High temperature rigid TPS Active cooling Ablators	Needed	Needed